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The PEARL PaleoLimno Database (PPLD)

Technical and User's Manual

Protecting our environment. Ontario

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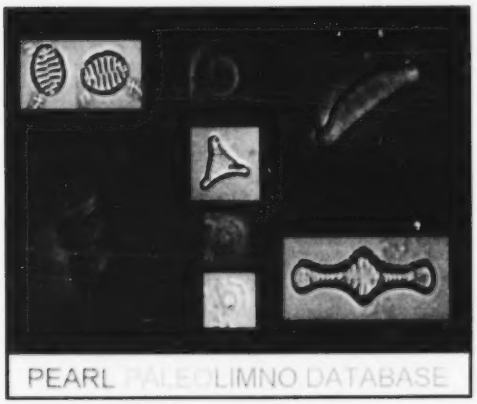

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1.0 Introduction

Paleolimnology is a multi-disciplinary science that uses the information preserved in lake sediments to evaluate long-term environmental change (Smol 2002). Significant advancements have been made in this field over the past two decades, including improvements to coring techniques, taxonomy, statistical analyses, and data interpretation. Paleolimnology has been transformed from a purely descriptive science to one of hypothesis testing and quantitative prediction. As a result, paleolimnological data are now being used to study many issues of global importance. Predictive models developed from biological indicators (e.g., diatoms, chrysophytes, chironomids, cladocerans) have been developed to provide long-term data regarding the impact and, in some cases, recovery from lake eutrophication, acidification, contamination from point-source and long-range pollutants, climate change, as well as other issues. These studies have resulted in close to a hundred scientific reports and publications from Ontario sites alone. As of 2003, paleolimnological data have been generated for close to 500 lakes in Ontario.

Given the importance and volume of these data, it is essential that they be properly catalogued. Relational databases are intuitive and have proven useful for managing large datasets. For example, at the Ontario Ministry of Environment Dorset Environmental Science Centre (DESC), databases are presently maintained for hydrological (Futter et al. 1993), meteorological (Hutchinson et al. 1994), water chemistry, and biological data (e.g., zooplankton data: Pawson and Yan 1993).

With these precedents, the Paleoecological Environmental Assessment and Research Lab (PEARL) PaleoLimno Database (PPLD) was created in 2001 to act as a central location for regional paleolimnological data. In 2002-03, data from Ontario calibration sets and core samples were compiled and added to the PPLD in collaboration with the Ontario Ministry of Environment.

In general, the database serves to house biological proxy data (Paleo) and water body data (Limno). More specifically, the objectives of the database are as follows:

- to centralize paleolimnological data from sites in Ontario;
- to provide a complete description of each sample, including the project affiliation, site name, sample year, sampling device used, depth of coring, length of core, and the biological proxy analysed;
- to provide relevant geographical, physical, and chemical data for each site;
- to report information regarding the enumeration of samples, including the sample analyst, biological proxy, genus name, species name, and abundance data;
- to identify analyst-specific taxonomy and synonym lists for biological proxies;
- to provide a list of peer-reviewed scientific publications from sites in Ontario; and
- to identify the location of archived samples, including a contact name and address.

Concomitant to the principal of centralization, it is imperative that, although copies of the database may be made and distributed, all corrections and new data be entered at the designated database computer at the Paleoecological Environmental Assessment and Research Lab (PEARL), Queen's University, Kingston, Ontario.

This report summarizes the overall design of the PPLD, with particular reference to sites in Ontario. It is written in two parts. The first, the "Technical Manual", provides detailed information regarding the contents and relational structure of the data tables. This guide is aimed at those who have a detailed knowledge of Microsoft Access©, and is for use only when the database has been corrupted, requires changes, or when additions are desired. The second, the "User's Manual", which is duplicated in full in the database help index, provides general instructions on the use of the database. This guide will allow a new user to become familiar with, and to fully exploit, the database.

2.0 Glossary of Terms

This glossary provides the user with definitions of terms that will be used throughout the user's guide. The first section contains database terms; the second section contains paleolimnological terms.

2.1 Database Terms

Table: houses data in rows ("records") and columns ("fields"). Tables within the database are linked to one another via "relationships".

Query: retrieves data from a table based on certain criteria (e.g. Elevation > 245 m; Salinity < 0.5 g/L; Project = "Muskoka-Haliburton"). Queries are identical in appearance to tables.

Form: a user-friendly interface used for adding, editing, deleting, and retrieving data. The "tools" on the form are the drop-down boxes, list boxes, text boxes, and check boxes described below. These tools are often bound to underlying data, although, in other cases, they are used to retrieve records and data (see "Bound / Unbound" below).

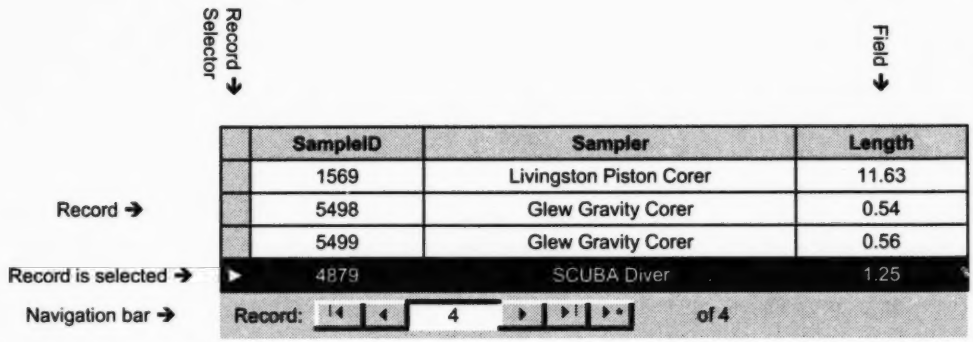
Report: a graphical representation of a data retrieval.

Record: a row of information in a table. A table may contain millions of records. A single form will represent the contents of a single record, while a continuous form will represent all records of the data set, one beneath the other.

Field: a specific column / variable in a table (e.g. latitude, genus, etc.). A table may contain up to 256 columns. On any form, a field will be represented by a single control – a drop-down box, list box, text box, or check box.

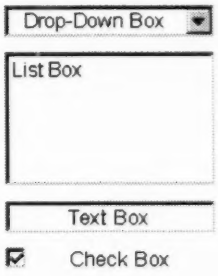
Record Selector: arrow button to the left of the record in a table or continuous form. When a record is highlighted by clicking on the record selector, it may be deleted by pressing the "Delete" button on the keyboard.

Navigation Bar: bar at the bottom of tables and forms that allows the user to move through the records with arrow buttons. It gives both the total number of records in the data set and the current position in those records.



Drop-down Box: a single-line box of one or more entries that may be selected. To show the entries, the user may press "Alt + Down Arrow" or, with the mouse, click on the arrow within the box itself. Typing in the drop-down box will bring up the entry that matches the text and pressing "Enter" will select that entry.

List Box: a multi-line box of one or more entries that may be selected. An entry may be selected by clicking on it with the mouse. One or more of these entries may be selected depending on how the "Select" property is set. If the property is set to "Multi-select" then holding the "Ctrl" button while clicking will select individual entries; holding the "Shift" button while clicking will select all entries between the current entry and the one previously selected. If the "Select" property is set to "Single", however, only one entry may be selected.



Text Box: a single-line box in which text is typed directly. Unlike the drop-down box and the list box, there are no choices available to the user for the text box, and so the user can enter any text value, although this may be subject to formatting restrictions. For example, in a text box for a date value, the format might be restricted to YYYY/MM/DD.

Check Box: a box that has two or three options – true, false, or null.

Bound / Unbound: refers to whether or not the boxes listed above are linked to underlying data or not. Often, boxes on a form represent data within the database, and so entering a value in one of these boxes will change data values in the database. In other cases, though, changing a value in a box simply acts to change the criteria in a query for data retrieval.

Front End: the part of the database that is visible to the user on a normal start-up – primarily the forms, queries, and reports. Some tables, however, are accessible through the "Maintenance" section of the database.

Back End: the part of the database that is invisible to the user on a normal start-up – specifically, the major tables that need to be protected to prevent accidental data corruption or deletion. Opening the back end gives the user certain privileges that are not allowed under a normal start-up, such as deleting records and access to important tables. To access the back end of the database, see "Accessing the Back End" under the "Maintenance" section of the help index.

Relationships: the way in which tables in the database are related to one another. All the relationships used in this database are "one-to-many" relationships – that is, a record in one table may have an unlimited number of related records in the related table.

2.2 Paleolimnological Terms

Biological Proxy (aka **Indicator**): a taxonomic group (e.g., diatoms, chironomids) that is enumerated in paleolimnological samples. For these groups, species characteristics along environmental gradients (e.g. pH, salinity) can be calculated by comparing water chemical values to relative species abundances from recent sediment deposition in a range of lakes. In this way, proxy taxonomic groups can serve as indicators of changing environmental conditions over long periods of time when sediment cores are extruded from lacustrine sediments.

There are two broad classifications of data in this database:

Biological Proxy Data: include the raw counts of each species in every sample;

Body of Water Data: key information regarding the sampling site (e.g., geographic location and physical-chemical attributes) is summarized in the body of water data.

These data are used for two different purposes:

Calibration Data: refer to samples analysed from the top of sediment cores (i.e. recent sediment deposits), representing modern or present-day conditions. Within regions, these data may be related to body of water data to understand the ecological relationships of species to their environment, and to create predictive models for reconstructing past environmental conditions.

Core Data: generated from several sediment samples within a sediment core, providing a long-term archive of past species assemblages, and thus environmental change.

3.0 Part I – Technical Manual

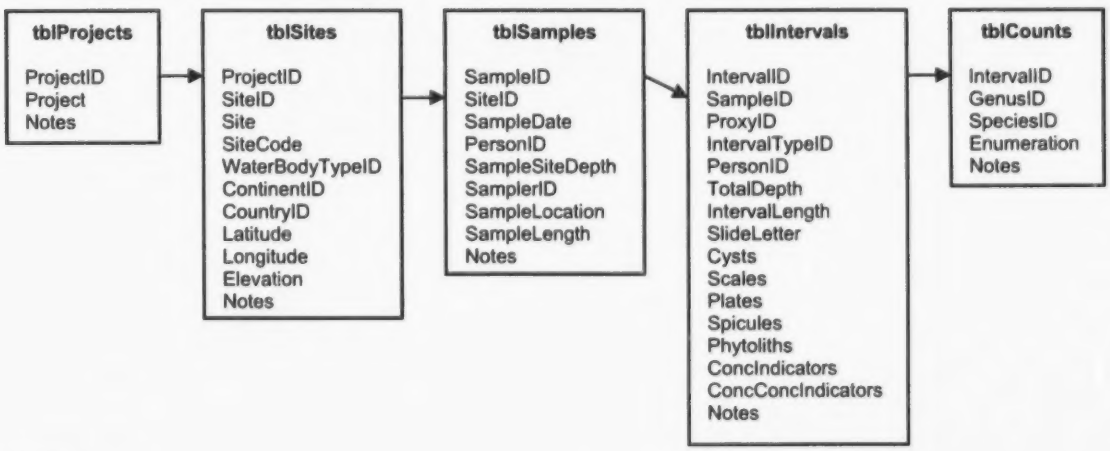
3.1 Structure and Contents of the Database

The design of the database is one of structured hierarchies. The purpose of this design is to protect data from accidental corruption, to ensure that all the data conform to a specific shape, and for ease of use. This philosophy is evident in the forms by which the data are entered and retrieved, where the selection of an entry or entries from a drop-down box or a list box determines the values displayed in a subordinate control.

The relationships of the PPLD are one-to-many with cascade deletes and cascade updates. These relationships are shown in each of the following sections in simplified form.

There are five main sections to the database: projects, sites, samples, intervals and counts; proxies, genera and species; people; publications; and water body data.

3.1.1 Projects, Sites, Samples, Intervals, Counts



tblProjects

ProjectID	:	Unique identifier of the project; automatically generated
Project	:	Name of the project (e.g. Muskoka-Haliburton)
Notes	:	General notes on the project

tblSites

ProjectID	:	Unique identifier of the project; linked to tblProjects
SiteID	:	Unique identifier of the site; automatically generated
Site	:	Name of the site (e.g. Chalk Lake)

SiteCode	:	Code given to the site by the author (e.g. CHLK98)
WaterBodyTypeID	:	Unique identifier of water body type (e.g. lake, pond, reservoir, etc.); linked to tblWaterBodyTypes
ContinentID	:	Unique identifier of continent on which the site is located; linked to tblContinents
CountryID	:	Unique identifier of country in which the site is located; linked to tblCountries
Latitude	:	Latitude of the site (DMS - 11° 22' 33")
Longitude	:	Longitude of the site (DMS - 111° 22' 33")
Elevation	:	Elevation of the site in metres above sea level
Notes	:	General notes on the site

tblSamples

SampleID	:	Unique identifier of sample; automatically generated
SiteID	:	Unique identifier of site; linked to tblSites
SampleDate	:	Date on which the sample was taken
PersonID	:	Unique identifier of sampler; linked to tblPeople
SampleSiteDepth	:	Depth of water in metres from which the sample was taken
SamplerID	:	Unique identifier of sampling device used to take sample; linked to tblSamplers
SampleLocation	:	Where the sample is currently stored (e.g. PEARL – Cold Room – Box 39)
SampleLength	:	Length of the sample taken in centimetres
Notes	:	General notes on the sample

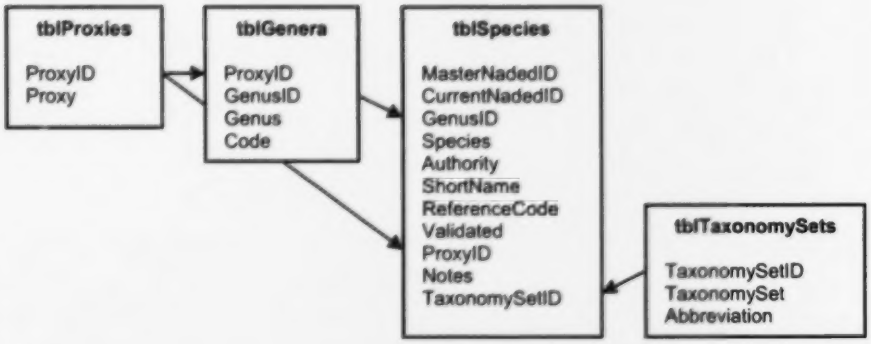
tblIntervals

IntervalID	:	Unique identifier of the interval; automatically generated
SampleID	:	Unique identifier of sample from which the interval came; linked to tblSamples
ProxyID	:	Unique identifier of the proxy enumerated for the interval; linked to tblProxies
IntervalTypeID	:	Unique identifier of the interval type (e.g. top, bottom, regular); linked to tblIntervalTypes
PersonID	:	Unique identifier of the person who analysed the interval; linked to tblPeople
TotalDepth	:	Depth of interval along sample (in centimetres)
IntervalLength	:	Length of the interval in centimetres
SlideLetter	:	Letter of the slide(s) that were analysed (e.g. A, B, C, D)
Cysts	:	Alternative indicator; number of enumerated chrysophyte cysts
Scales	:	Alternative indicator; number of enumerated chrysophyte scales
Plates	:	Alternative indicator; number of enumerated siliceous protozoan plates
Spicules	:	Alternative indicator; number of enumerated sponge spicules
Phytoliths	:	Alternative indicator; number of enumerated phytoliths
ConcIndicators	:	Concentration indicator; number of enumerated concentration indicators

ConcConcIndicators: Calculated concentration of concentration indicators for reference
Notes : General notes on the interval

tblCounts
IntervalID : Unique identifier of interval whence the enumeration came; automatically generated
GenusID : Unique identifier of the genus enumerated; linked to tblGenera
SpeciesID : Unique identifier of the species enumerated; linked to tblSpecies
Enumeration : The number of the species enumerated for the interval
Notes : General notes on the count

3.1.2 Species



tblProxies
ProxyID : Unique identifier of the proxy; automatically generated
Proxy : Name of the proxy (e.g. diatoms, chironomids, etc.)

tblGenera
ProxyID : Unique identifier of the proxy to which the genus belongs; linked to tblProxies
GenusID : Unique identifier of the genus; automatically generated
Genus : Name of the genus (e.g. *Achnanthes*)
Code : Two- or three-letter code that represents the genus (e.g. AC); used in generation of eight-character ShortName (tblSpecies)

tblSpecies
MasterNadedID : Unique identifier of the species; automatically generated
CurrentNadedID : Reference number to parent species for synonyms; automatically generated, but updateable
GenusID : Unique identifier of the genus to which the species belongs; linked to tblGenera
Species : Name of the species
Authority : Name of the authority that described the species

ShortName	:	Eight-letter identifier of the species
ReferenceCode	:	Code taken from Philadelphia Academy of Natural Sciences database (PANS)
Validated	:	Binary option; true for species that came from PANS, false for new species that have not been cross-referenced
ProxyID	:	Unique identifier of the proxy to which the species belongs; linked to tblProxies
Notes	:	General notes on the species
TaxonomySetID	:	Taxonomy set to which species belongs; linked to tblTaxonomySets

tblTaxonomySets

TaxonomySetID	:	Unique identifier of taxonomy set; automatically generated
TaxonomySet	:	Name of taxonomy set (e.g. Normal, PIRLA, Andrew Paterson)
Abbreviation	:	Two-letter abbreviation of taxonomy set name for use in species ShortName (e.g. PR, AP; Normal set has no abbreviation)

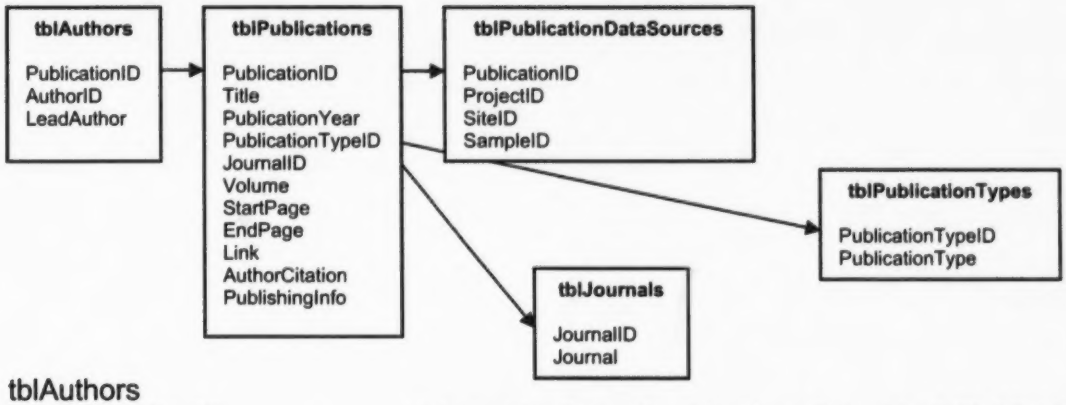
3.1.3 People

This table is very simple but is central to almost every other group.

tblPeople

PersonID	:	Unique identifier for person; automatically generated
FirstName	:	First name of the person
MiddleName	:	Middle name of the person
LastName	:	Last name of the person
Suffix	:	Suffix of the person (e.g. 'Jr.', 'Sr.', 'III', etc.)
CountryID	:	Unique identifier of the country where the person is located; linked to tblCountries
Telephone	:	Office telephone number of the person
Extension	:	Extension of the office telephone, if necessary
Fax	:	Facsimile number
E-mail	:	E-mail address
Notes	:	General notes on the person

3.1.4 Publications



tblAuthors

PublicationID	:	Unique identifier of publication; linked to tblPublications
AuthorID	:	Unique identifier of author; linked to tblPeople
Lead Author	:	Unique identifier of lead author

tblPublications

PublicationID	:	Unique identifier of publication; automatically generated
Title	:	Title of the publication
PublicationYear	:	Year in which the work was published
PublicationTypeID	:	Unique identifier of publication; linked to tblPublicationType
JournalID	:	Unique identifier of journal; linked to tblJournals
Volume	:	Volume number of the journal / book to which the publication belongs
StartPage	:	Beginning page of the publication
EndPage	:	Ending page of the publication
Link	:	Web link to article
AuthorCitation	:	Citation of the authors in specific order
PublishingInfo	:	Other publication information

tblPublicationDataSources

ProjectID	:	Unique identifier of the project from which the publication is derived; linked to tblProjects
SiteID	:	Unique identifier of the project from which the publication is derived; linked to tblSites
SampleID	:	Unique identifier of the project from which the publication is derived; linked to tblSamples
PublicationID	:	Unique identifier of the publication; linked to tblPublications

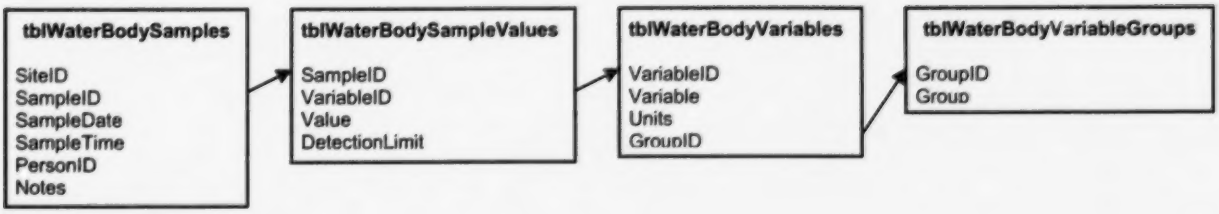
tblJournals

JournalID	:	Unique identifier of journal; automatically generated
Journal	:	Name of the journal (e.g. Journal of Paleolimnology)

tblPublicationTypes

PublicationTypeID	:	Unique identifier of the publication type; automatically generated
PublicationType	:	Publication type (e.g. journal, book, thesis, etc.)

3.1.5 Water Body Data – Chemical and Physical



tblWaterBodySamples

SiteID	:	Unique identifier of the site from which the sample was taken; linked to tblSites
SampleID	:	Unique identifier of the sample; automatically generated
SampleDate	:	Date on which the sample was taken
SampleTime	:	Time at which the sample was taken
PersonID	:	Unique identifier of the person who took the sample; linked to tblPeople
Notes	:	General notes on the sample

tblWaterBodySampleValues

SampleID	:	Unique identifier of the sample; linked to tblWaterBodySamples
VariableID	:	Unique identifier of the variable measured; linked to tblWaterBodyVariables
Value	:	Measured value in the units specified in the variable (e.g. 5.6 g/L)
DetectionLimit	:	Binary option; true for measured value being at or below detection limit of sensors; false for real value

tblWaterBodyVariables

VariableID	:	Unique identifier of the variable; automatically generated
Variable	:	Name of the variable (e.g. Potassium, Depth, Salinity, etc.)
Units	:	Units by which the variable is measured (e.g. g/L, mg/L, °C, etc.)
GroupID	:	Unique identifier of group to which variable belongs; linked to tblWaterBodyVariableGroups

tblWaterBodyVariableGroups

GroupID	:	Unique identifier of group; automatically generated
Group	:	Name of group to which water body variables belong (e.g. Physical, Trophic, Ions)

4.0 Part II – User's Manual

Each of the major topics in this section corresponds to an item on the main menu of the PPLD database. The last option on the main menu, the help index, which is not represented here, replicates this section of the manual in full.

4.1 Enter Data

a) General Overview

Clicking on the "Enter Data" button on the main menu opens the "Enter Data" form. All data entry, with the exception of "People" and "Publications" (see below), can be done from this form. Selecting a project, site, sample, and interval (in descending order) activates the "Enumeration" sub-form and raw proxy counts can then be entered.

Clicking on the "Add" and "Edit" buttons beside these four drop-down boxes will bring up appropriate forms. When a site, sample, or interval is to be added, the database assumes that the new entry belongs to the project, site, or sample (respectively) that is selected in the drop-down box above. For this reason, the user should ensure that the appropriate value is selected in the drop-down box immediately above. In order to edit a project, site, sample, or interval, simply select the item from the appropriate drop-down box and click on the button to the right, under the "Edit" label and the appropriate form will pop up.

b) Specific Forms

i) Project

The "Project Data" form simply contains notes on the project.

ii) Site

There are three components to "Site Data" form. First, there are the general features about the lake, country, GPS location, elevation, and water body type. The next section houses information on the lake and its chemistry (e.g. surface area, total phosphorus, etc.). The data that are entered must be related to a date on which they were gathered. Data collected on different dates may be added or edited

by scrolling with the navigation bar underneath the form. Lastly, there is a "Notes" section for general notes about the site.

iii) Sample

The "Sample Data" form allows the user to add and edit information on cores and other types of samples, such as plankton net tows, et cetera.

iv) Interval

The "Add" and "Edit" forms for intervals are the only two forms that are different of the four selections. This is to allow the user to add multiple intervals at a time for a core. For the "Add Intervals" form, all fields must be completed before the "Make Intervals" command can be run successfully. Of note, the user should be particularly careful of the "Distance Between Intervals" box. Entering zero in this field would result in an infinite number of intervals being produced, and so is not allowed, but any very low number will result in the production of a large number of intervals. Alternatively, if only one interval is required (e.g. for a surface sample), the top and bottom interval depths should be the same and the distance between intervals will be inconsequential.

v) Entering Raw Counts

To enter a count, the user must first select a genus from the drop down box, then the species, then the enumeration, then any notes on the count (optional). The user can then press the "Tab" key to move to the next record. As this can be an arduously repetitive process, it is recommended that the user save time by using "short-cut keys" (see Appendix I). The species percentage and the total slide count are automatically calculated as the records are entered. If the species does not exist as an option in the "Species" drop-down box, then it must be added to the database via the "Add Species" form (see below). If the genus does not exist as an option, then it must be added directly to the table of genera via the "Maintenance" form.

vi) Adding a New Species

There are several rules that have been created to ensure similarity amongst users. Due to their complexity, these rules are not enforced by the database, and so it is up

to the user to follow these rules to ensure the use of consistent taxonomy in the database. When adding a species to the database, the user should follow the instructions in Appendix III of this manual.

4.2 Retrieve Data

a) General Overview

Clicking on the "Retrieve Data" button on the main menu opens the "Retrieve Data" form. The majority of the form (i.e. the first five of six tabs) is devoted to finding and selecting the data of interest via a number of multi-select list boxes and text boxes. The last tab allows the user to perform three different types of searches on the selected records.

b) Selecting Data

The selection of data from the "Retrieve Data" form is hierarchical, like the "Enter Data" form, and follows the same pattern. For example, selecting a project will bring up all the sites belonging to that project. The major difference is that, whereas the "Enter Data" form requires specific selections from the drop-down boxes, the "Retrieve Data" form allows the user to select one, many, or all entries from any of the list boxes. The selected records are then used in the search functions.

c) Searching Data

There are three ways to search the data entered into the database – proxy data, water body data, and species data.

i) Proxy Data

The "Proxy Data" search retrieves data from selected intervals and species. All intervals where the "Minimum Enumeration" criterion is satisfied, and all species that are selected on the "Species" tab and meet the "Minimum Abundance" and "Minimum Occurrences" criteria, will appear in the resulting data table. Because Access© tables are limited to 256 columns, if there are more than 250 species, then more than one table will be generated, with an upper limit of 1000 species.

ii) Water Body Data

The "Water Body Data" search retrieves water body data from the selected samples. In order to appear in the resulting data table, the samples must first be selected in the "Samples" list and then meet all of the criteria specified in the "Water Variable Criteria" sub-form. All variables are displayed against these samples.

iii) Species Data

The "Species Data" search function unites the data from the previous two searches. It matches biological proxy samples with water body samples from the same lake based on the specified "Maximum Difference" in days between the two samples. It is important to note that the database makes no distinction between intervals from deep in the sediment and those at the top; it is up to the user to ensure that only the latter are selected. The data may be viewed in tabular or graphical form.

d) Exporting Data Output

To export data table outputs from the database to Microsoft Excel, simply press the "Export to Excel" button on the "PEARL PaleoLimno Database" toolbar. Alternatively, press "Ctrl-A" to select the entire table contents and "Ctrl-C" copy them to the clipboard. Close the file and open a spreadsheet. Dump the contents of the clipboard onto the spreadsheet by pressing "Ctrl-V". Data can also be exported to Microsoft Word or Notepad in this fashion.

4.3 People

a) General Overview

The "People" portion of the database is meant to keep basic records of those who are related to PEARL or who have contributed data to the PPLD. The "People" form is quite simple, even though the data that underlie it are linked to most every other part of the database.

Selecting a person from the list box to the left of the form brings that person's details up in the text boxes to the right, which may be edited.

In order to add a person, simply press the "Add Person" button at the bottom left of the form. After entering the new person's details, press the "Refresh List" button next to the "Add Person" button and the new person will be present in the list.

4.4 Publications

a) General Overview

There are two portions to the "Publications" form – search and edit. The search section allows the user to find publications that match selected criteria, while the edit section allows the user to enter publications and information about them. At any time, the user may add a publication by pressing the "Add Publication" button.

b) Search and Select

Criteria selected or entered in the boxes to the left of this tab automatically update the list box to the right of the form with the matching entries. Double-clicking on one of these entries will bring it up on the Add and Edit tab.

c) Add and Edit

This section allows the user to add and edit publications. When the "Add Publications" button at the bottom of the form is pressed, this tab is readied for a new entry, and the user can begin to enter the publication details, then entering authors.

i) Authors

Authors are sorted by the order in which they are entered. After the authors have been entered, the user should click on the "Update" button to update the "Author Citation" text box in the publication details section.

ii) Data Used for Publication

This sub-form houses references to the data upon which the publication was based. They are selected in a hierarchical fashion (i.e. "Projects" before "Sites" before "Samples"). Any number of these selections may be made by scrolling with the navigation bar at the bottom of the sub-form.

iii) Publication Details

These are the data that are used in citation, including the author citation, year, title, journal, page numbers, and other publication information. It also includes a link that, when clicked, if the user has permission to access the page, will bring up an electronic version of the publication.

4.5 Maintenance

a) General Overview

The maintenance form is a method by which an experienced user can add or edit data in the database without entirely exposing what is referred to as the "back end" – i.e. the tables and relationships that underlie the "front end" to which the user is exposed. In this way, the data are protected while allowing limited changes to be made. Most buttons in the "Maintenance" form allow the user to add new data directly into tables so that they may be retrieved from drop-down boxes in other forms. In addition, the user can view the database relationships as well as maintain help topics.

c) Backing-up the Database

Periodically, the database will need to be backed-up to safeguard against data loss. Back-ups should be done at regular intervals (monthly) and before any major changes are to be made (deleting records, deleting tables, accessing the back end, changing passwords, etc.).

Currently, the working copy of the database is located in the directory, "C:\Database" of the PEARL Database Computer, Department of Biology, Queen's University, Kingston, Ontario. Wherever the database is backed-up (e.g. CD-ROM or hard drive), it is important to include the date in the filename.

d) Accessing the Back End

When the PEARL database is run, the main menu is automatically activated and most other features are deactivated. The purpose of this limitation is to protect the database from accidental corruption. In order to access the back end (the hidden portion of the database where all the data is housed), one needs to hold down the "Shift" key while

double-clicking the icon. This brings up the database window instead of the default start-up form and allows access to all functions.

d) Compressing the Database

Periodically, a database should be compressed. This helps the database run faster and eliminates wasted space. Currently, the "Compress on Close" option in MS Access (Tools, Options, General) is set to "True", and so compression is carried out automatically each time PPLD is shut down.

e) Deleting Data

At times, it may be necessary to delete data that have been entered (e.g., because of accidental duplicate entries). A record that has a record selector arrow beside it can easily be deleted simply by clicking on the record selector and pressing the "Delete" button.

To delete records where this button is not present (e.g. projects, sites, samples, or intervals) is more difficult. This is an intentionally built-in aspect to the database that serves to protect the data from accidental deletion. Direct access to most of the tables in the database can be achieved through the "Maintenance" form. In order to gain access to all the tables, one must enter the back end. (See "Accessing the Back End" under the "Maintenance" category.)

WARNING: When one deletes data in this fashion, there are no protection mechanisms or second chances to recuperate the data. Once data are deleted, they cannot be brought back (i.e., there is no "Undo" button). Furthermore, deleting a record will delete all subordinate records in the hierarchy. That is, deleting a site will also delete all the samples listed under that site and all the intervals listed under those samples.

5.0 References

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Appendix I – Shortcut Keys

Shortcut keys allow the user to move through records and options much more quickly than would otherwise be possible using the mouse. Knowledge of these shortcuts is a great asset, especially when doing repetitive data entry.

- Alt + Down Arrow: shows the choices available in a drop-down box
- Tab: moves the focus to the next field; if focus is on last field, then focus moves to the first field of the next record if cycle property set to "All Records" or back to the first field of the current record if cycle property set to "Current Record"
- Ctrl + Tab: moves the focus from a tab or sub-form to an adjacent tab or to the main form
- Shift + Tab: serves the same function as Tab, but moves the focus to the previous record
- Alt + Letter: selects the option which has an underlined letter for the form with the focus
- Escape: cancels updates to the current record; equivalent to clicking the "Cancel" button present on most forms
- Delete: deletes the current record when it is selected

Appendix II – Protocol for Adding a New Species

It is important, when adding a new species to the database, that the user follows a certain protocol so that the database does not become muddled with many different taxonomic names for the same species. The following protocol has been developed to ensure that this does not happen.

- Normal Species
  - enter full species name
  - e.g. *Stephanodiscus minutulus*
- Split Groups
  - names separated by a backslash with space on either side
  - order is alphabetical
  - e.g. *Stephanodiscus minutulus / parvus*
- Affinities
  - denote after the species, with comma after species
  - e.g. *Stephanodiscus minutulus*, cf.
- Sub-varieties
  - leave only a space between species and variety
  - e.g. *Achnanthes minutissima affinis*
- Unknown species
  - spp.
  - e.g. *Navicula* spp.
- Taxonomy set species
  - sp. + number + taxonomy set
  - e.g. *Cymbella* sp. 2 PIRLA

Appendix III – Quicksheet: Editing Species Synonyms

The Species Synonyms form is accessed from the Retrieve Data form under the Species tab.

General tips:

- The page is split down the middle – the left half representing the old naming system, the right half representing the new. The taxa on the right half are those that appear in the searches performed by the database.
- The New Species drop-down box contains all the species of the selected genus / family that are not themselves synonyms to other species. This restriction ensures that the user cannot create synonyms that refer to other synonyms.

Specific tips:

- First, a proxy must be selected from the Proxy Type drop-down box. This action will populate the List of Synonyms.
- In order to edit or remove an entry:
    - Select the entry from the list in order to populate the Old and New Species Name drop-down boxes.
    - To edit a synonym entry, change the New Species Name drop-down boxes to reflect the desired changes.
    - To remove the entry from the list, simply select the original taxon nomenclature in the New Species Name drop-down boxes to match the Old Species Name.
- In order to add an entry:
    - Select the genus and species from the Old Species Name drop-down boxes.
    - Select the genus and species of the updated taxon name from the New Species Name drop-down boxes.
- Click the Enter Synonym button to update the entry. This action will change the Species ID number of the Old Species to refer to the New Species ID number. If the two ID numbers are different, the changes will be shown in the List of Synonyms. If the two ID number are the same, the entry will be eliminated from the list.
- Notes can be made on the Old Species. In this section, the source that indicated that the species was a synonym should be cited.